Hazard Elimination Project Evaluation

Project Log # 200502099

Hazard Elimination Project W-3805

Widen SR 5214 (Matthews-Mint Hill Road / Old NC 51) from US 74 to NC 51 to Convert From a 2-Lane Facility to a 3-Lane Facility with a Two-Way Center Left Turn Lane And Add Auxiliary Lanes at Selected Locations
Mecklenburg County

Documents Prepared By:

Safety Evaluation Group
Traffic Safety Systems Management Section
Traffic Engineering and Safety Systems Branch
North Carolina Department of Transportation

Principal Investigator

_____ 5/19/2006_____
Carrie L. Simpson, EI Date

Traffic Safety Project Engineer

Hazard Elimination Project Evaluation Documentation

Subject Location

Evaluation of Hazard Elimination Project W-3805 –
On SR 5214 (Matthews-Mint Hill Road / Old NC 51) from US 74 to NC 51 in Mecklenburg County

Project Information and Background from the Project File Folder

The safety countermeasure chosen for the subject location was to widen SR 5214 (Matthews-Mint Hill Road) to provide a TWLTL (Two-Way Left Turn Lane) from US 74 to NC 51. The project widened the roadway from a two-lane section to a three-lane section. Right turn lanes were also added (and curb and gutter provided) along the entrances to David W. Butler High School. The High School was constructed before the project started. The conversion from a two-lane facility to a three-lane facility is only the interim treatment for this location. The ultimate treatment is to widen this section to a five-lane curb and gutter facility. The speed limit on SR 5214 (Matthews-Mint Hill Road) is 45 mph. Note that SR 5214 (Matthews-Mint Hill Road) was the old NC 51 before Matthews Township Parkway was constructed and NC 51 was rerouted in 1994.

The initial crash analysis for this location was completed from August 1, 1994 through July 31, 1997 with a total of 14 reported crashes. According to the initial crash analysis, there were four Rear End crashes and ten Random crashes. The Project Report in the Project File Folder states that the lack of left-turn lanes in the two-lane, two-way roadway resulted in the Rear End crashes. Motorists were slowing or stopped in the thru lane, attempting to make left turns. The project was completed on August 23, 1997 at a cost of $675,000.

Naïve Before and After Analysis

After reviewing the hazard elimination project file folder along with all the crashes at the subject location, the crash data omitted from this analysis to consider for an adequate construction period was from March 1, 1997 through February 28, 1998. The before period consisted of reported crashes from March 1, 1990 through February 28, 1997 (7 Years) and the after period consisted of reported crashes from March 1, 1998 through February 28, 2005 (7 Years). The ending date for this analysis was determined by the available crash data at the time the crash analysis was completed.

The treatment data consisted of all crashes on SR 5214 (Matthews-Mint Hill Road) within a 0' Y-Line from US 74 to NC 51. Please see the attached *Location Map* for further detail. The following tables depict the Naïve Before and After Analysis for the Total Crashes and Target Crashes at the treatment location. Please note that the Target Crashes for the applied countermeasure were Rear End Crashes, Left Turn-Same Roadway (LTSR) Crashes, and Sideswipe Crashes.

Table 1a. Total Treatment Information	**Before**	**After**	**Percent Reduction (-)/ Percent Increase (+)**
Total Crashes	94	146	55.3%
Total Severity Index	3.93	3.24	-17.6%
Target Rear End Crashes	43	64	48.8%
Target Rear End Severity Index	3.24	3.31	2.2%
Target LTSR Crashes	9	15	66.7%
Target LTSR Severity Index	1.82	4.45	144.5%
Target Sideswipe Crashes	2	16	700.0%
Target Sideswipe Severity Index	4.70	1.46	-68.9%
Volume	16,100	14,100	-12.4%

Table 1b. Total Crash Information	**Before**	**After**	**Percent Reduction (-)/ Percent Increase (+)**
Fatal Injury Crashes	0	0	N/A
Non-Fatal Injury Crashes	28	35	25.0%
Total Injury Crashes	28	35	25.0%
Night Crashes	19	19	0.0%
Wet Crashes	25	27	8.0%

The following tables depict the Naïve Before and After Analysis for the Total Crashes and Target Crashes at three separate segments of the treatment location. The treatment location is broken down into the Treatment Strip, Intersection Leg 1, and Intersection Leg 2. The data was broken down in this manner because the crashes that occurred within the vicinity of the intersections of SR 5214 at US 74 (Intersection Leg 1) and SR 5214 at NC 51 (Intersection Leg 2) appear to be more impacted by the intersection than by the treatment. In addition, the crashes included within the Treatment Strip appear to provide a better representation of the treatment's effects. Intersection Leg 1 includes all crashes on SR 5214 within approximately 500 feet of the intersection with US 74. Intersection Leg 2 includes all crashes on SR 5214 within 150 feet of the intersection with NC 51. The Treatment Strip includes all crashes at the treatment location not included within Intersection Leg 1 or 2. The crashes included in Intersection Leg 1 and 2 are circled in red on the attached Collision Diagrams.

Table 2a. Treatment Strip	Before	After	Percent Reduction (-)/ Percent Increase (+)
Total Crashes	31	47	51.6%
Target Rear End Crashes	21	11	**-47.6%**
Target LTSR Crashes	3	6	100.0%
Target Sideswipe Crashes	2	7	250.0%

Table 2b. Intersection Leg 1 US 74 at SR 5214	Before	After	Percent Reduction (-)/ Percent Increase (+)
Total Crashes	59	72	22.0%
Target Rear End Crashes	19	27	42.1%
Target LTSR Crashes	7	9	28.6%
Target Sideswipe Crashes	0	9	N/A

Table 2c. Intersection Leg 2 NC 51 at SR 5214	Before	After	Percent Reduction (-)/ Percent Increase (+)
Total Crashes	4	27	575.0%
Target Rear End Crashes	3	26	766.7%
Target LTSR Crashes	0	0	N/A
Target Sideswipe Crashes	0	0	N/A

The naïve before and after analysis for the entire treatment location resulted in a 55.3 percent increase in Total Crashes, a 48.8 percent increase in Rear End Crashes, a 66.7 percent increase in LTSR Crashes, a 700.0 percent increase in Sideswipe Crashes, and a 12.4 percent decrease in Average Daily Traffic (ADT). Further investigation shows there was a 17.6 percent decrease in the Severity Index for Total Crashes. Also, within the Treatment Strip, Rear End Crashes decreased by 47.6 percent. The before period ADT year was 1993 and the after period ADT year was 2001.

Results and Discussion

The naïve before and after analysis involving the comparison of treatment actual before data versus treatment actual after data resulted in a 55.3 percent increase in Total Crashes, a 48.8 percent increase in Rear End Crashes, a 66.7 percent increase in LTSR Crashes, and a 700.0 percent increase in Sideswipe Crashes. Further investigation shows a 17.6 percent decrease in the Severity Index for Total Crashes. The summary results above demonstrate that the Treatment Location appears to have had an increase in the number of Total and Target Crashes from the before to the after period using naïve methodologies.

The TWLTL (Two-Way Left Turn Lane) allows simultaneous left turns from the center lane. Vehicles from either direction of traffic flow enter the center lane to make left turns, thus removing themselves from the through lanes. In general, this may increase the capacity of the through lanes, reduce vehicular conflicts, and enable traffic to move more efficiently. Therefore the Target Crashes for this countermeasure include Rear End, Left Turn-Same Roadway, and Sideswipe crashes.[1]

The Treatment Location has been separated into three segments to better analyze the crashes. The Treatment Strip segment excludes all crashes on SR 5214 that occurred at the intersections with US 74 or NC 51. The Treatment Strip contains approximately 32 percent of the Total Crashes in the after period. The TWLTL has a direct effect on this segment because it extends through its entire length. The number of Total Crashes in this segment increased by 51.6 percent from 31 crashes in the before period to 47 crashes in the after period. The number of Rear End Crashes decreased by 47.6 percent from the before to the after period, as is expected with this type of countermeasure. However, the number of LTSR Crashes and Sideswipe Crashes increased by 100.0 and 250.0 percent, respectively. The increase in Total, LTSR, and Sideswipe Crashes may be explained by the increase in access points along the Treatment Strip from the before to the after period. David W. Butler High School opened in the fall of 1997. With increased numbers of access points comes an increased potential for crashes to occur at them.

Intersection Leg 1 includes crashes that occurred on SR 5214 from the intersection with US 74 to approximately 500 feet east of the intersection. This segment was extended back 500 feet from the intersection to include crashes occurring at the access points closest to the intersection. Intersection Leg 2 includes crashes that occurred on SR 5214 within 150 feet of the intersection with NC 51. Please see the Collision Diagrams and the Aerial Photo for a visual depiction of the Treatment Location. Crashes included within the Intersection Leg 1 and 2 segments are circled in red on the Collision Diagrams. The crashes within Intersection Leg 1 are also enlarged for better viewing. The TWLTL does not have a direct effect on these segments because it does not extend through either of them. Note that a thru lane, left-turn lane, and right-turn lane were present at Intersection Leg 1 in both the before and after periods. Also, the entrances to Fullwood Plaza, Wendy's, Firestone, and Sherwin Williams have remained unchanged from the before to the after period.

Intersection Leg 1 contains approximately 49 percent of the Total Crashes in after period.
The number of Total Crashes that occurred within the Intersection Leg 1 segment has increased by 22.0 percent from 59 crashes in the before period to 72 crashes in the after period. Several crash patterns are prevalent at Intersection Leg 1. The pattern of Rear End Crashes appears to be an issue of signal progression, which may be anticipated at signalized intersections. The Left-Turn and Angle Crashes appear to be related to the access control. Vehicles are attempting to cross up to four lanes of traffic to gain access to the commercial driveways located near the intersection. These Frontal Impact crash types may be mitigated by use of a median treatment that would not allow traffic to turn left into or out of the driveways.

Intersection Leg 2 comprised the remaining 19 percent of the Total Crashes in the after period. The number of Total Crashes that occurred within the Intersection Leg 2 segment has increased 575.0 percent from 4 crashes in the before period to 27 crashes in the after period. The most prevalent crash pattern within this segment is Rear End Crashes. The number of Rear End Crashes increased by 766.7 percent from 3 crashes in the before period to 26 crashes in the after period. This

substantial increase in Rear End Crashes is potentially related to the increased traffic volumes generated from the high school.

The TWLTL and auxiliary lanes were not the only changes imposed on the Treatment Location from the before to the after period. The effect of the high school on the Treatment Location was analyzed. The high school produces additional traffic volume and changes the characteristics of drivers using the roadway. The number of Total Crashes that occurred between the hours of 7-9 a.m. and 2-4 p.m. increased by 126.7 percent from 30 crashes in the before period to 68 crashes in the after period. Forty-seven (47) percent of the Total After-Period Crashes occurred within this 4 hour time period when a majority of students are travelling to and from school. The age of at-fault drivers involved in crashes was also analyzed but did not appear to be greatly affected. The average age of the at-fault driver in the before period and the after period were 31 years old and 33 years old, respectively.

The re-routing of NC 51 away from the Treatment Location and onto Matthews Township Parkway also had the potential to alter other driver characteristics. Trucks that were originally using Matthews-Mint Hill Road may now be using the new NC 51-Matthews Township Parkway. A look at vehicle styles from the before to the after period reveals the following. The number of crashes involving Single Unit Trucks decreased by 88.0 percent from 25 crashes in the before period to 3 crashes in the after period. The number of crashes involving Heavy Trucks increased from two crashes in the before period to four crashes in the after period. Also note that one PDO crash involving a school bus occurred in the after period.

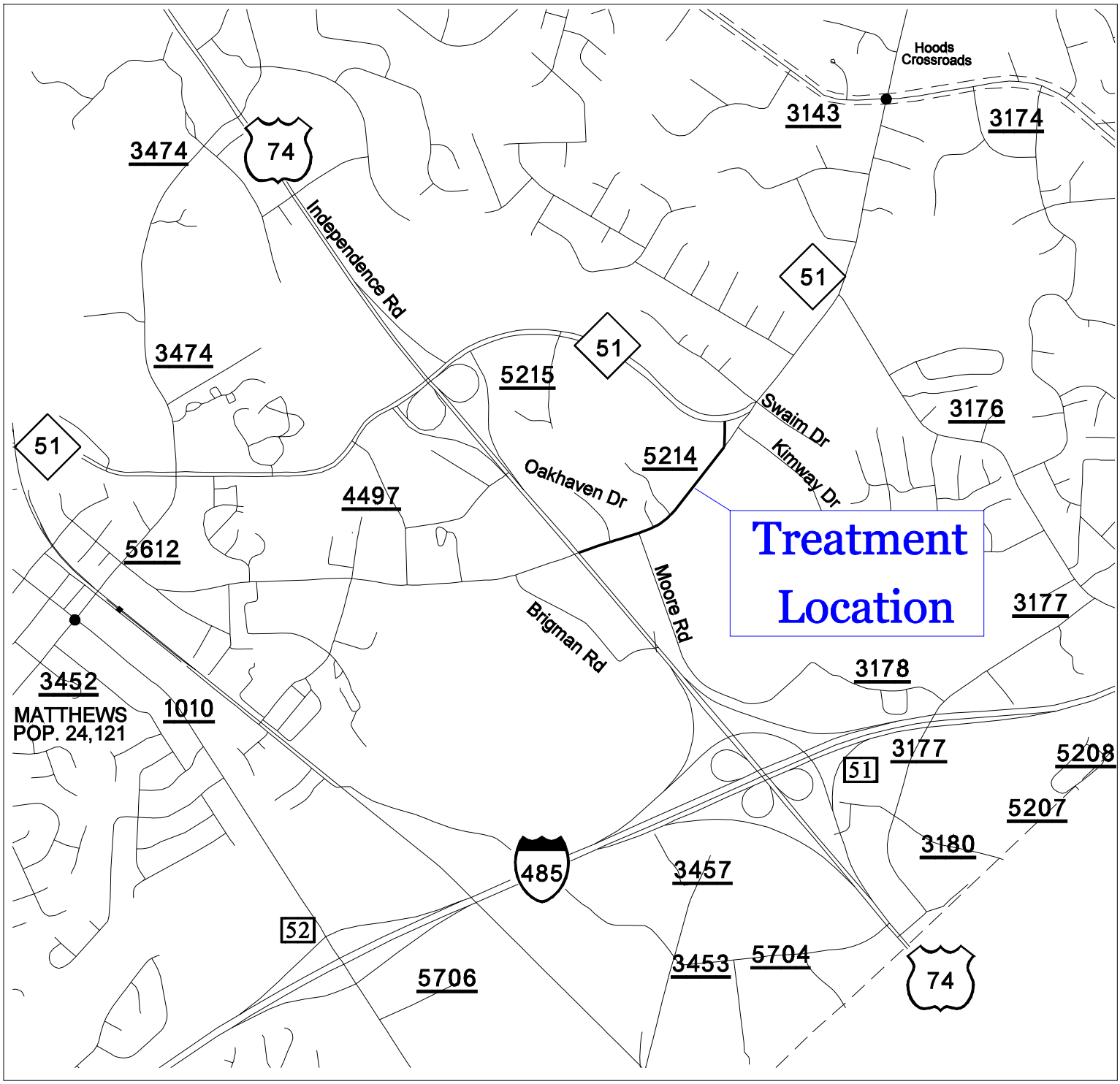
A majority of the Sideswipe Crashes in the after period were caused by vehicles making illegal passing maneuvers. The northbound lane of SR 5214 is wide, especially near the intersection with US 74. Some vehicles were attempting to pass stopped traffic within the thru travel lane. In other cases, vehicles used the TWLTL as a passing lane when traffic in front of them was stopped.

Please see the attached Treatment Site Photos. The photos were taken while driving north on SR 5214 (Matthews-Mint Hill Road) and depict the current TWLTL. As the Safety Evaluation Group completes additional reviews for this type of countermeasure, we will be able to provide more objective and definite information regarding actual crash reduction factors.

Reference:

1. "Two-Way Left-Turn Lane" By John McCree
   Illinois Municipal Review / July 1987

Location Map
Hazard Elimination Project W3805
Mecklenburg County



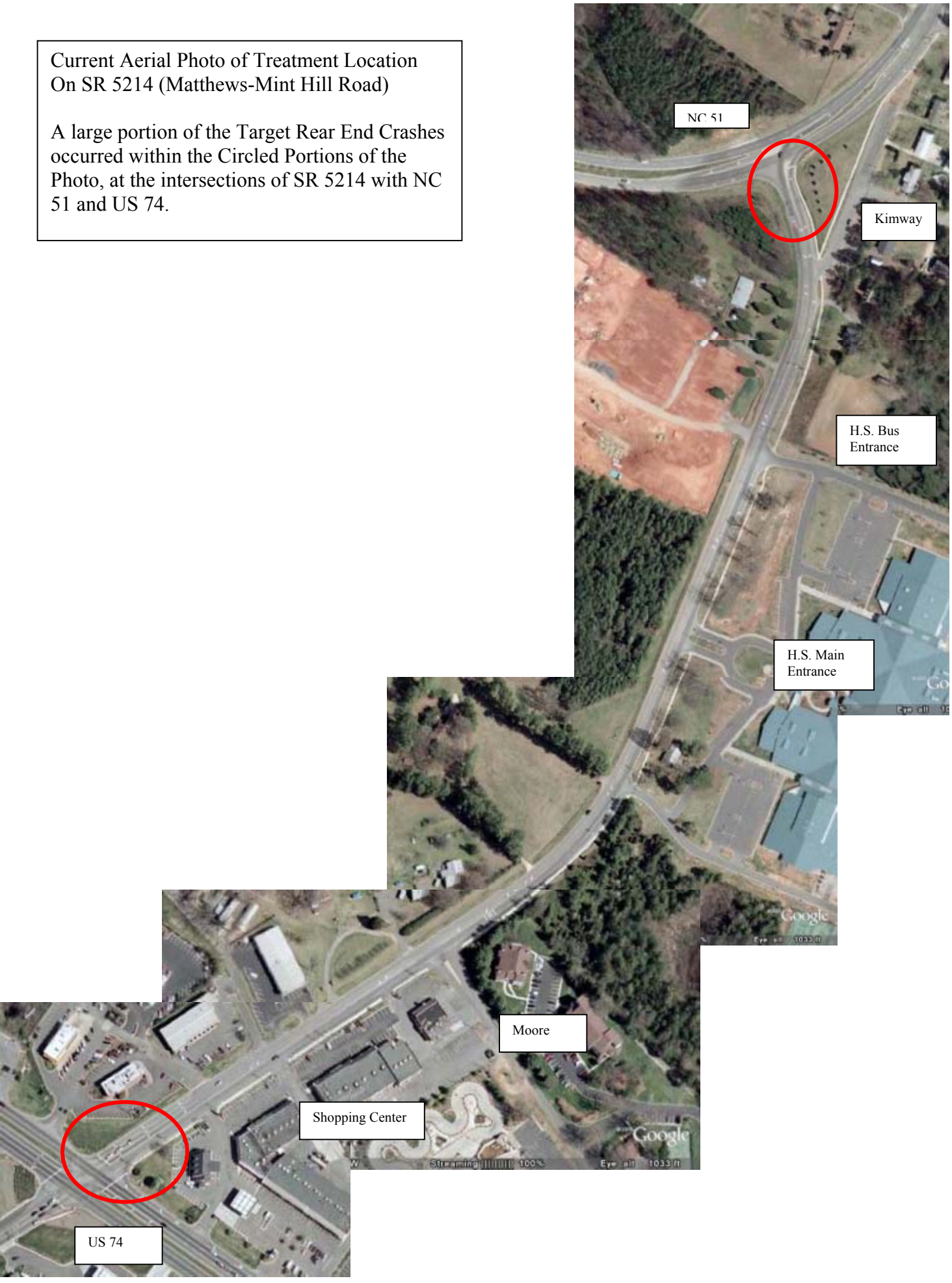
Treatment Location:

On SR 5214 (Matthews-Mint Hill Road / Old NC 51)

From NC 51 to US 74 (0.67 Miles)

Current Aerial Photo of Treatment Location
On SR 5214 (Matthews-Mint Hill Road)

A large portion of the Target Rear End Crashes occurred within the Circled Portions of the Photo, at the intersections of SR 5214 with NC 51 and US 74.



Treatment Site Photos (Taken on February 28, 2006)

Driving north on SR 5214 (Matthews-Mint Hill Road) near the southern project limits, the intersection with US 74.

Driving north on SR 5214 (Matthews-Mint Hill Road) near Fullwood Plaza.

Treatment Site Photos (Taken on February 28, 2006)

Driving north on SR 5214 (Matthews-Mint Hill Road) north of Moore Road.

Driving north on SR 5214 (Matthews-Mint Hill Road) near the high school main entrance.

Treatment Site Photos (Taken on February 28, 2006)

Driving north on SR 5214 (Matthews-Mint Hill Road) near the high school bus entrance.

Driving north on SR 5214 (Matthews-Mint Hill Road) at Kimway Drive.

Treatment Site Photos (Taken on February 28, 2006)

Driving north on SR 5214 (Matthews-Mint Hill Road) at the northern project limits, the intersection with NC 51.

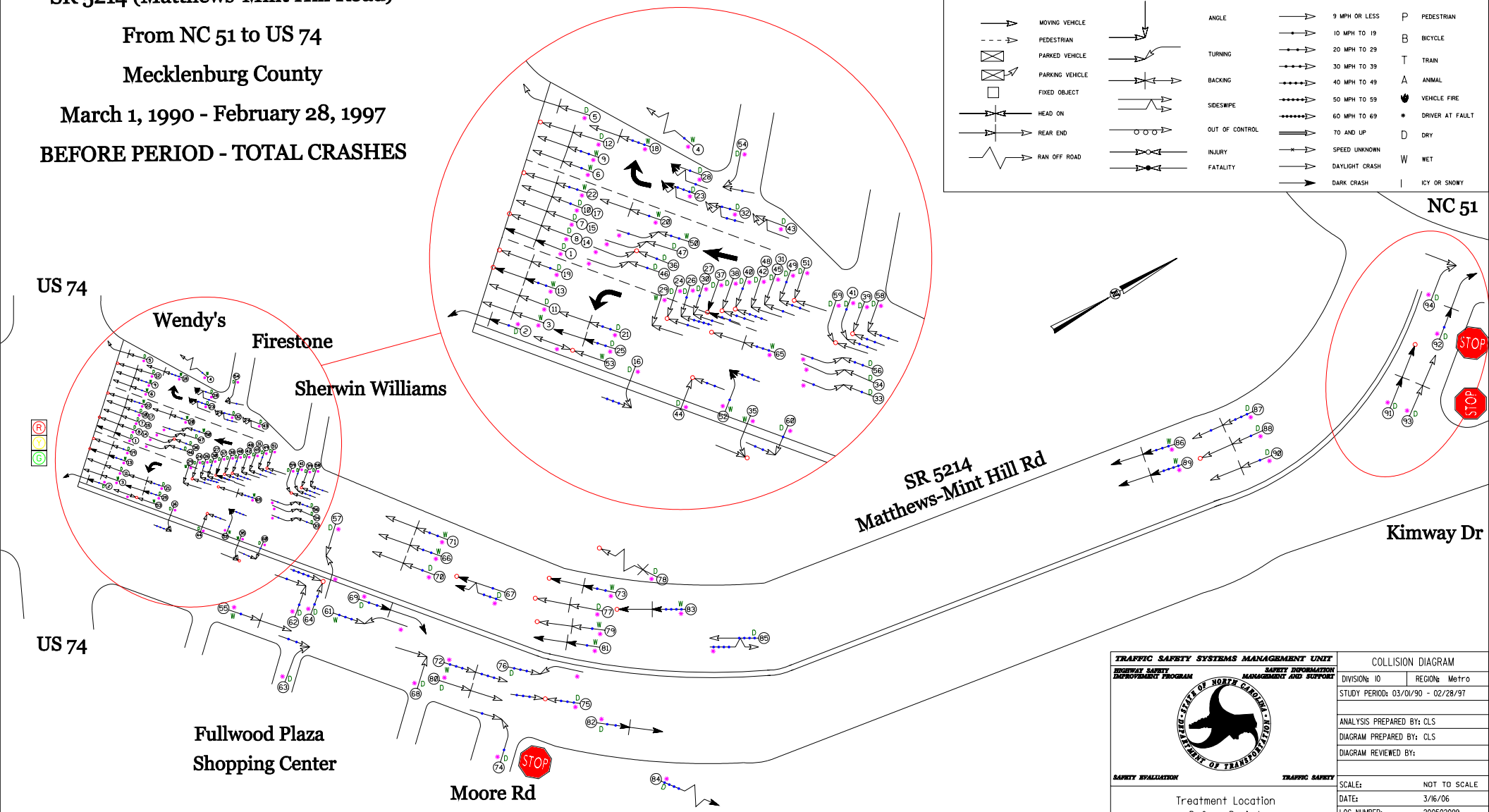
SR 5214 (Matthews-Mint Hill Road)

From NC 51 to US 74

Mecklenburg County

March 1, 1990 - February 28, 1997

BEFORE PERIOD - TOTAL CRASHES



TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT

HIGHWAY SAFETY IMPROVEMENT PROGRAM — SAFETY INFORMATION MANAGEMENT AND SUPPORT

SAFETY EVALUATION — TRAFFIC SAFETY

Treatment Location
Before Period

COLLISION DIAGRAM

DIVISION: 10	REGION: Metro
STUDY PERIOD: 03/01/90 - 02/28/97	
ANALYSIS PREPARED BY: CLS	
DIAGRAM PREPARED BY: CLS	
DIAGRAM REVIEWED BY:	
SCALE:	NOT TO SCALE
DATE:	3/16/06
LOG NUMBER:	200502099
PAGE:	1OF 1

N.C. DEPARTMENT of TRANSPORTATION
DIVISION of HIGHWAYS
TRAFFIC ENGINEERING AND SAFETY SYSTEMS BRANCH

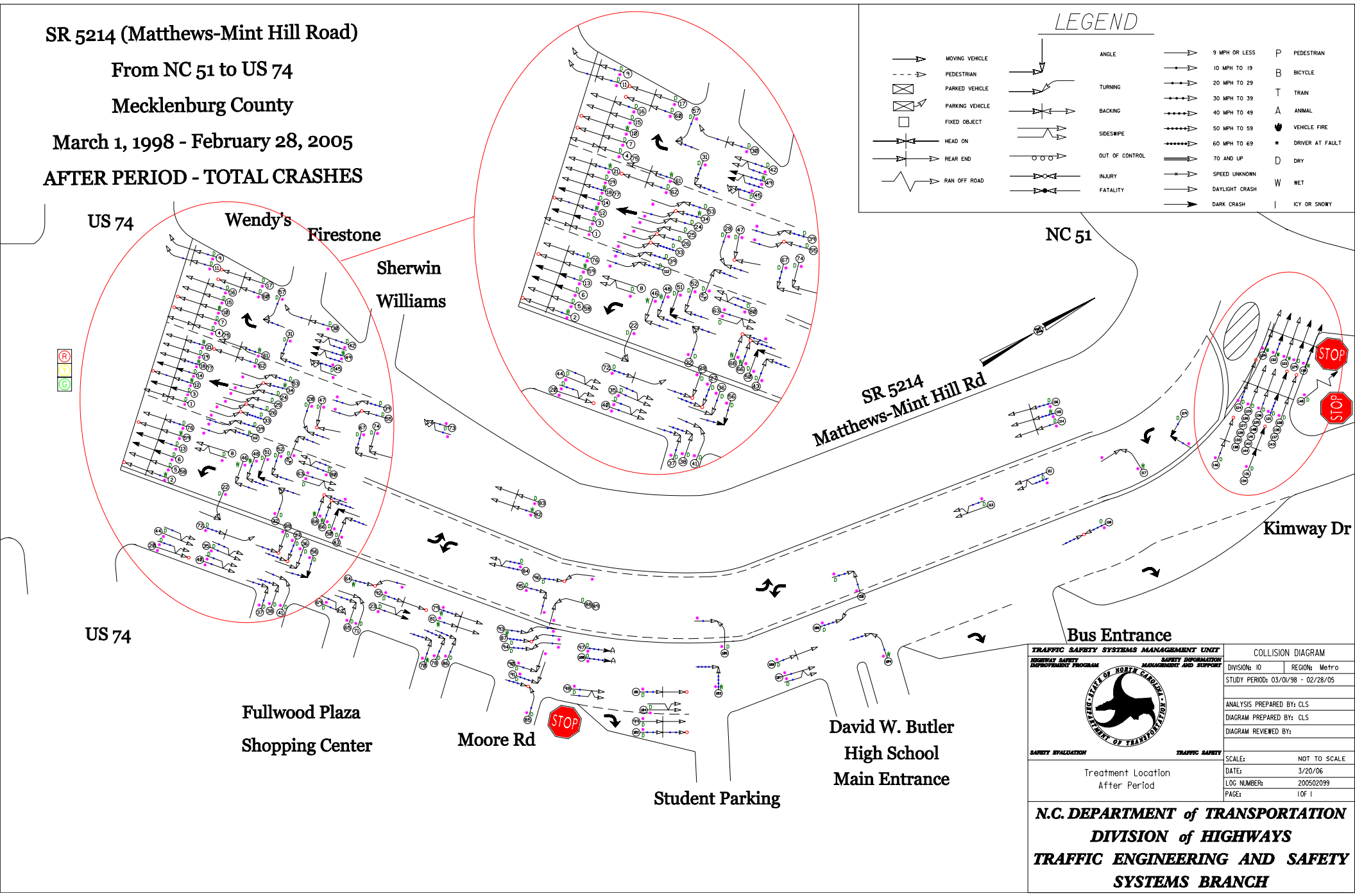
SR 5214 (Matthews-Mint Hill Road)

From NC 51 to US 74

Mecklenburg County

March 1, 1998 - February 28, 2005

AFTER PERIOD - TOTAL CRASHES



TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT

HIGHWAY SAFETY IMPROVEMENT PROGRAM | SAFETY INFORMATION MANAGEMENT AND SUPPORT

STATE OF NORTH CAROLINA · DEPARTMENT OF TRANSPORTATION

SAFETY EVALUATION | TRAFFIC SAFETY

Treatment Location
After Period

COLLISION DIAGRAM

DIVISION: 10	REGION: Metro
STUDY PERIOD: 03/01/98 - 02/28/05	
ANALYSIS PREPARED BY: CLS	
DIAGRAM PREPARED BY: CLS	
DIAGRAM REVIEWED BY:	
SCALE:	NOT TO SCALE
DATE:	3/20/06
LOG NUMBER:	200502099
PAGE:	1 OF 1

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DIVISION of HIGHWAYS
TRAFFIC ENGINEERING AND SAFETY SYSTEMS BRANCH